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Death to the rodents.

(1921)

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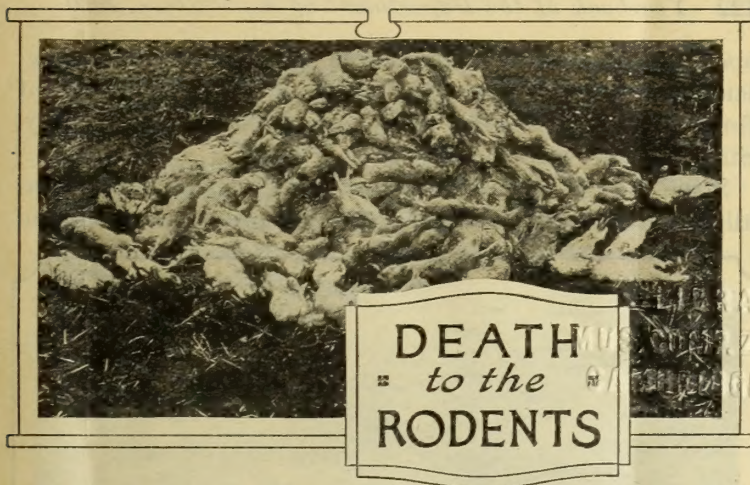
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DEATH  
to the  
RODENTS

By W. B. BELL,

*Assistant Biologist in Economic Investigations,  
Bureau of Biological Survey.*

**T**O ELIMINATE a crop-production loss of \$500,000,000 a year, due to rodents, looks like a staggering undertaking. When a leak is detected in a corporation, mill, or factory and a means of prevention is found, it is possible to issue orders putting improved practice into effect forthwith. Not so in the case of losses caused by rodent pests: you can not order the rodents to stop eating.

The magnitude of the task is measured by the length and breadth of the whole of the United States, and its execution requires not only action by Federal and State officials, but the voluntary cooperation of hundreds of thousands of people who must be enlisted in the movement. A great educational campaign must be conducted to fix public attention upon the need, to give assurance as to the practical character of the methods to be employed, and to obtain concerted action by private, State, and Federal agencies. Plans and means of organization must be provided, trained and experienced leadership secured, cooperation of great numbers of people effected, legislation enacted, financial support furnished, and special supplies procured and laid down at the point of use.

The actual carrying forward of this work has afforded a fine instance not only of willingness to cooperate but of co-

operation put into effective, harmonious, and widely correlated action on a large scale, involving many thousands of farmers and stockmen, their organizations, and county, State, and Federal officials.

Some idea of the seriousness of the losses suffered annually from the native rodents, including prairie dogs, ground



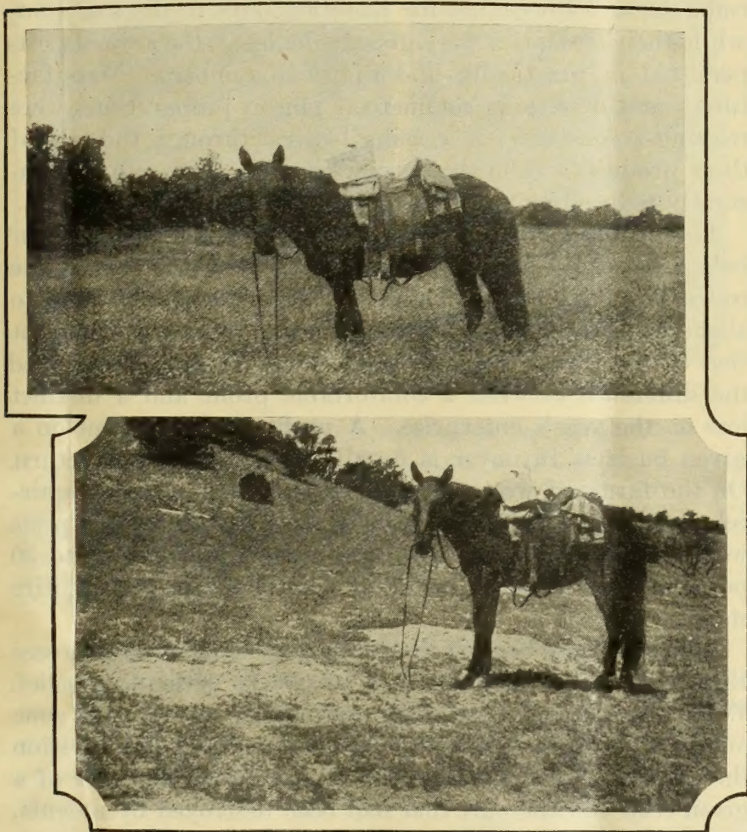
Results of Prairie-Dog Activities.

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A close-up view showing detail of work of prairie dogs on a heavily infested area. All valuable forage grasses, including their root systems, had been completely destroyed, leaving only a few scattering clumps of weeds and wire grass. Not less than 100,000,000 acres of range and agricultural lands are infested by prairie dogs, these animals selecting the most productive valleys and bench lands for their devastating activities. After poison treatment, 55 dead prairie dogs were counted on the area in the illustration.

squirrels, pocket gophers, and jack rabbits, may be obtained from the following estimates submitted during the fiscal year 1917 by certain State directors of agricultural extension: Montana, \$15,000,000 to \$20,000,000; North Dakota, \$6,000,000 to \$9,000,000; Kansas, \$12,000,000; Colorado, \$2,000,000; California, \$20,000,000; Wyoming, 15 per cent of all crops; Nevada, 10 to 15 per cent of all crops, or \$1,000,000; New Mexico, \$1,200,000 loss to crops and double this amount to range. In a single county of Virginia, losses of or-

chard trees from depredations of pine mice from 1915 to 1917 were estimated at not less than \$200,000. Similarly heavy losses were disclosed in other States as attention was directed to these direct causes of decreased production. It is estimated that native rodents cause a loss of \$150,000,000 a year in the United States in cultivated crops and a similar loss in forage on the pasture ranges, making a total loss of \$300,000,000 a year from this source.



B20742; B20743

Effect of Prairie Dogs on Range Production.

Upper view, an area which has not yet been invaded by prairie dogs, showing the natural stand of grama grass, one of the most valuable range forage plants. Lower view, from photograph taken at the same time of a near-by area invaded by prairie dogs. Here these pests have completely destroyed all valuable forage grasses, reducing the stock-carrying capacity to zero.

### Eating Up the Margin of Profit.

For many years farmers and stockmen, in numerous instances driven to the verge of desperation by constantly recurring losses, endeavored to clear their holdings of rodent pests, only to find their methods ineffective or their lands constantly reinfested by animals coming in from adjacent Government lands or from those of their less thrifty and energetic neighbors. Large sums were expended by States, counties, and townships for bounties, only to disclose that, while their treasuries were greatly depleted, the animal pests persisted in practically undiminished numbers. Manufacturers and dealers in commercial poison preparations were reaping a constantly increasing harvest through the sale of their products, while the farmer saw his crop returns constantly reduced by the inroads of rodent pests.

The Biological Survey received many urgent appeals for help from the far-western States, the cry being that if the rodents could not be controlled the people would have to abandon their ranches. In many instances it was apparent that the portion of the crop eaten by the rodents represented the difference between a comfortable profit and a distinct loss on the year's enterprise. A profit of 10 per cent on a given business turnover is usually accounted a fair return. On the farms of western States prairie dogs, ground squirrels, pocket gophers, jack rabbits, and similar rodent pests were commonly cutting down the crop yields 10, 20, and 30 per cent, and in many instances were destroying the entire stand.

When farmers became aware of the extent of these losses they were eager to learn how to obtain permanent relief. When Department specialists and county agents had gone out into the grain fields and demonstrated beyond question the amount of loss involved, by measuring off the area of a given crop and the part that had been destroyed by rodents, the farmers began to see the importance of having this margin placed on the credit side of the farm account book or in their bank, instead of having it consumed for the immediate requirements of these myriads of small raiders or stored as fat for their subsistence while indulging in their long hibernation sleep.



B20730: B20729

**Destructive Activity of Prairie Dogs on Cultivated Crops.**

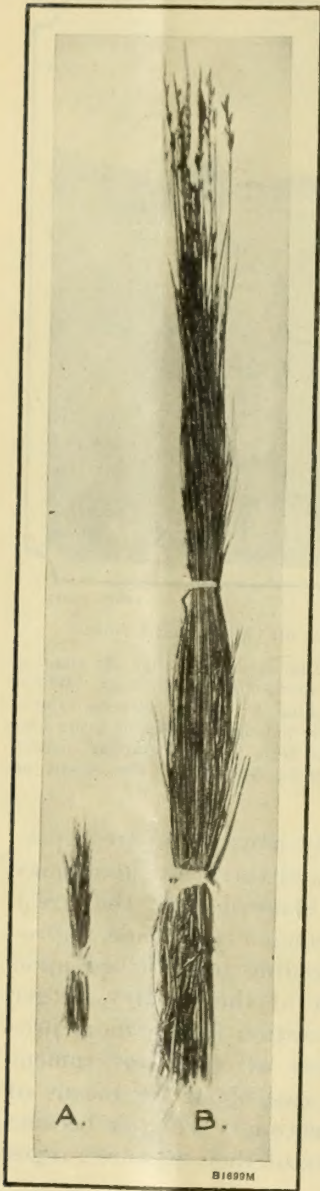
At left, field of oats, showing normal production at harvest time; at right, a contrasting view of a portion of the same field invaded by prairie dogs. Where the prairie dogs have attacked the crop, nothing is left to harvest. Corn, wheat, oats, rye, barley, feterita, and alfalfa are among the valuable grain and hay crops of the United States which prairie dogs, ground squirrels, pocket gophers, jack rabbits, and similar rodent pests destroy to the extent of \$150,000,000 annually.

As long as stockmen could merely move on to fresh pastures with their flocks and herds and there was abundance for all comers, there was little concern over the great stretches of fertile range lands denuded and made unproductive by the hosts of rodents feeding undisturbed upon them. With increasing settlement of the country, larger numbers of live stock, keener competition for the more productive ranges, and reduced areas of free Government pasture lands, stockmen began to cast about for means of maintaining their live-stock production. When it became apparent that the carrying capacity of their pasture ranges

was being reduced from 10 to 50 per cent or more by the prairie dogs and ground squirrels, which occupied the most fertile and favorably situated valleys and bench lands, denud-

ing them of grass and rendering them useless for pasturage purposes, it became evident that eradication of these animals was the most practical way of providing additional forage to maintain and increase flocks and herds.

Fortunately, positive evidence that the carrying capacity of pasture ranges could be greatly increased by this means was at hand. Large areas of Government lands, cleared of rodents by Biological Survey field parties, had shown quick recovery of forage grasses and a marked increase in the number of cattle and sheep that could be carried on them. Smaller demonstration plots, which had been established under similar conditions to illustrate the difference in productivity between infested and cleared areas, showed grass knee high on the land where rodents had been destroyed and reinvasion prevented, as contrasted with grass cropped close to the ground on land immediately adjoining, where the rodents had been left in their usual numbers.



Typical Grass Specimens from  
Experimental Plots.

A, The best samples found in the inclosure where the prairie-dog population was normal. B, Sample of normal production in adjacent plot, where prairie dogs had been eradicated and reinfestation prevented.



### Going After the Rodents.

Up to and including the year 1916 the Biological Survey had worked largely on field investigation of damage caused by prairie dogs, ground squirrels, pocket gophers, jack rabbits, field mice, and related pests, together with study and experimentation to determine effective methods for their control or eradication in localities where they were proving seriously destructive of crops and range grasses.

Field-party operations against prairie dogs had been conducted on 15 national forests in Arizona, Colorado, Montana, New Mexico, Utah, and Oklahoma, on the Crow In-



B19696

Biological Survey Field Party Distributing Poisoned Grain to Destroy Rodent Pests.

Over 132,000 men working afoot and on horseback in cooperative campaigns distributed 1,610 tons of poisoned grain on more than 32,000,000 acres of range and farm land during the year 1920. The resulting destruction of prairie dogs and ground squirrels effected a saving of \$11,000,000.

dian Reservation in Montana, the Fort Sill Military Reservation in Oklahoma, and on considerable areas of public lands in Wyoming. Similar operations against ground squirrels had been undertaken on the California and Sequoia National Forests, and other forests in Modoc, Monterey, Kern, and Santa Barbara Counties, Calif.; on a small area in the vicinity of Sopris, Colo.; and on the Fort Totten Indian Reservation, N. Dak. A small amount of work had been done against pocket gophers on the Sequoia and Tahoe National Forests, Calif.; the Nebraska National Forest, Nebr.; and the Ochoco National Forest, Oreg. Some demonstrations had also been given to show farmers and stock-

men how to protect crops and hay from destruction by jack rabbits.

During 1916, 1,356,429 acres of Government lands were given original treatment for the eradication of prairie dogs, and 164,755 acres, previously poisoned, were given a second treatment to complete the work; 208,950 acres were treated for the destruction of ground squirrels; and 7,770 acres for the extermination of pocket gophers. Some demonstration work also was done to enable farmers and ranchmen to apply on their own lands the methods which the Biological Survey



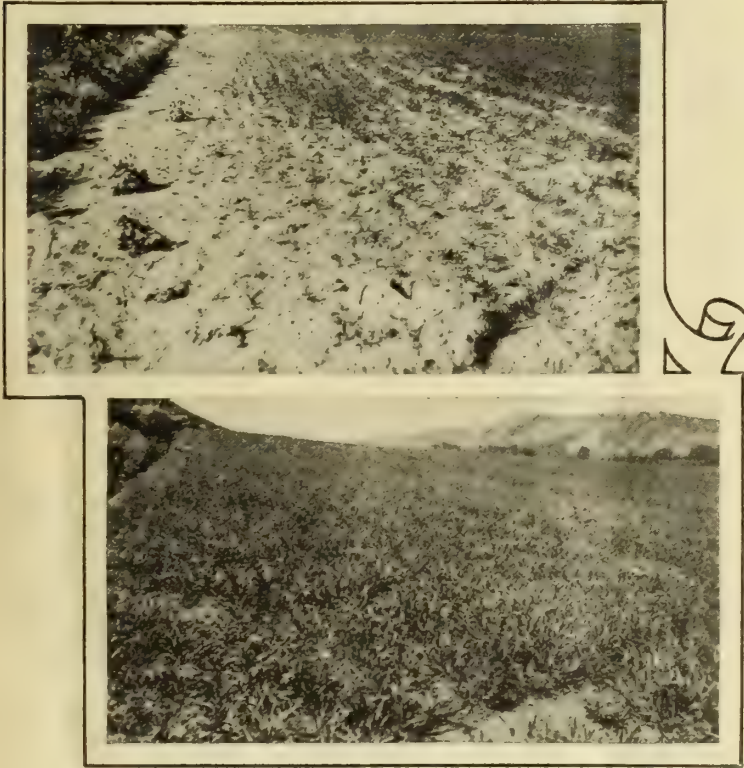
Results of Poison Properly Prepared and Distributed.

B19712

Pile of 1,872 prairie dogs, picked up on 320 acres after poison was distributed by men working according to directions of the Biological Survey. A large percentage of animals killed were not collected, as they entered the burrows before the poison could act. The grass required to feed these animals is sufficient for the maintenance of several head of cattle or sheep. Results such as this have convinced stockmen and farmers that this work is practical and worth while as a means of increasing production.

had found most effective in eradicating rodent pests on Federal lands. Demonstrations were given and campaigns organized to combat jack rabbits in infested farming communities of southern Idaho, central and eastern Oregon, southwestern Utah, northern Nevada, western Texas, and in smaller areas in California. Extermination of rodents that destroy seeds and nursery stock on areas being reforested had been completed on the Black Hills National Forest, S. Dak., and the Florida National Forest, Fla. Experiments to devise eradication methods had been conducted on the above planting areas and on the Converse Experiment Sta-

tion of California. Improved methods for controlling pine mice, wood rats, and other seed-eating rodents also were developed.



Ground-Squirrel Work in Grain Fields.

B18593; 618590

The upper view is of a field of oats, showing along the border the usual results of ground-squirrel activity in destroying the growing crop before eradication work was undertaken. A loss of 10 to 30 per cent of a field of grain occurred commonly before the cooperative campaigns were launched. The lower view is from a photograph of a field adjoining, where damage was prevented by poisoning the ground squirrels on the planted area and on adjacent fields of pasture land. Here it was possible to harvest a full crop from the entire area planted.

### Cooperation.

During the spring of 1916 the extended poisoning campaigns undertaken in North Dakota against ground squirrels—locally known as “gophers”—had the cooperation of the experiment station and extension service of the agricul-

tural college. The operations included demonstration of the most effective methods of destroying these pests in farming communities and the organization of systematic township and county campaigns. These animals were reported as causing crop losses aggregating from six to nine million dollars annually in the State. In this campaign the then enormous quantity of five-eighths of a ton of strychnine was used. This was prepared and applied to grain bait under supervision of Department of Agriculture and State experts according to methods determined through extended field experiments previously conducted by the Biological Survey and the State experiment station.

This work, organized in seven counties, was the beginning of systematic cooperative campaigns to clear of rodent pests great areas, involving Federal, State, and private lands, in which the costs were paid by the respective owners. The organized movement has gone forward with remarkably rapid strides because it has met a very important need in a practical, effective, and economical way.

These campaigns demonstrated that losses from rodent pests not only constitute an entirely unnecessary drain upon the productive capacity of the farms and stock ranges, but that they may be permanently eliminated at a cost which is but a small fraction of the damage occasioned during a single year. Where the expense for labor and poisoned materials is included, the cost of this work usually ranges between 4 and 10 cents an acre, depending on the kinds of animals and their abundance. Where the farmers and stockmen utilize the services of their regular farm and ranch help in distributing the poisoned grain on their land no increased cost of operation is involved except the cash outlay for poison supplies, which usually amounts to only 1 or 2 cents an acre.

By 1917 the time was ripe for correlating all rodent eradication activities in accordance with a unified but comprehensive plan. Work under the plan outlined by the Department of Agriculture for the organization of cooperative campaigns for the control of ground squirrels, prairie dogs, and jack rabbits (*Yearbook Separate No. 724, 1917*) was already progressing favorably in several States, and requests were received from officials and farmers to extend the service to include other States. Added stimulus was given the move-

ment by the world appeal to the United States at this time for cereal and meat products. Cutting off losses of grain crops due to rodent depredations, thus making possible the harvesting of the entire crop, was a most direct, practical, and economical way of increasing the available supply of grain. Farmers were prompt to recognize this and to join in the movement, as its effectiveness and value were demonstrated by Department specialists and county agents. Stockmen were quick also to see that the saving of alfalfa and range grasses from being eaten and uprooted by rodents afforded an immediate means of carrying and finishing for market greater numbers of cattle and sheep, thus increasing the urgently needed supply of meat, hides, and wool. With the enthusiastic and hearty cooperation of extension directors, county agents, State officials, farmers, and stockmen, the work has been extended until now it embraces thoroughly organized aggressive campaigns in 16 western States.

#### Four Tons of Strychnine for Prairie Dogs and Ground Squirrels.

The extent of operations at the present time is indicated by the fact that in cooperative undertakings during the past year Biological Survey field men have guided farmers and stockmen in the destruction of prairie dogs and ground squirrels on over 18,000,000 acres of farm and range lands, and have re-treated 14,672,000 acres in follow-up work to complete eradication. The Survey parties, aided by labor contributed by cooperating farmers, have destroyed most of the prairie dogs and ground squirrels on approximately 1,000,000 acres of the public domain. More than 4,500,000 acres of public lands have already been largely freed from prairie dogs, and this work at the present time is closely correlated with the cooperative campaigns on private lands. Over 132,000 farmers and stockmen joined in this work, and 1,610 tons of poisoned grain were distributed on infested lands. This required the purchase, preparation, and use of over 4 tons of strychnine.

The estimated saving in crops and range grasses, based largely on statements of farmers and stockmen themselves, amounts to more than \$11,000,000 for the past season. Farmers report in many cases a crop return of \$15 to \$20 for each

dollar invested in the work, and a very marked increase in the stock-carrying capacity of the ranges. This may be illustrated by a recent statement that on 90,000 acres cleared of prairie dogs in Arizona, increased forage has been raised sufficient to feed an extra head of cattle to every 20 acres, or from 20 to 30 head on each section of land. The forester in charge of the Santa Rita Range Reserve, in New Mexico, reports that 2,305 acres, previously of little value because practically all of the forage was consumed by prairie dogs, have been partially restored for grazing purposes, and that when the work is completed this range will carry 75 to 100 additional stock annually.

*Acreage treated with poisoned baits for the eradication of prairie dogs and ground squirrels in Federal and cooperative campaigns, by States and fiscal years.<sup>1</sup>*

State.	Acreage treated.				
	1916	1917	1918	1919	1920
Arizona.....	278,540	384,980	263,920	420,710	427,048
California.....	184,960	170,953	3,332,900	3,232,224	1,070,814
Colorado.....	40,904	41,642	159,110	795,433	769,490
Idaho.....			277,751	737,433	240,252
Kansas.....					21,325
Montana.....	73,576	82,755	3,681,673	4,541,400	6,926,944
Nebraska.....					75,275
Nevada.....			85,000		161,231
New Mexico.....	177,010	95,435	1,167,094	951,618	607,156
North Dakota.....	4,960,160	4,537,600	5,487,580	4,000,000	5,991,275
Oklahoma.....				8,600	80,543
Oregon.....	5,390	13,000	717,600	724,000	317,850
South Dakota.....	52,371			600,000	1,310,200
Texas.....	107,293		3,000		
Utah.....			4,255	317,960	589,756
Washington.....				303,200	498,644
Wyoming.....	340,790	442,647	717,189	404,628	135,200
Total.....	6,220,994	5,769,012	15,897,072	17,037,206	19,222,993

<sup>1</sup> The year in each case ends with June 30.

### Pocket Gophers Take the Bait.

Success has attended similar lines of campaign for the destruction of pocket gophers, chiefly in Kansas, Nebraska, Idaho, Oregon, New Mexico, and Arizona. Reports have been received from many farmers that it was possible to



Pocket-Gopher Mounds in Cultivated Field.

813931

While burrowing underground, pocket gophers cut off the roots of alfalfa and other growing crops and of orchard trees, and pile up great mounds of dirt on the surface. These mounds cover up and destroy much of the crop, damage machinery used in harvesting, and interfere with its efficient operation.

destroy as many as 95 per cent of these animals through a single application of the poisoned bait. Pocket gophers occur in all States west of the Mississippi River and are particularly destructive to alfalfa, grazing lands, hay meadows, and root crops. A stand of alfalfa is often entirely ruined through the cutting off of the main branches of the root system. The quantity of hay that can be harvested is reduced both by this depletion of the stand and through being buried by the great mounds of dirt which are thrown up by pocket gophers. These mounds also interfere seriously with the operation of the harvesting machinery.

In addition to the direct damage caused by pocket gophers, their burrows frequently serve as an outlet for water from irrigation ditches. The flow of water through these small openings enlarges them, and breaks occur that result in serious loss of water and the flooding and destruction of crops. Such washouts also entail large expenditures in repairs. Burrows distributed over the irrigated areas also admit water when irrigation is in progress, frequently resulting in the washing of deep gullies on sloping land and also interfering seriously with the proper distribution of the available water supply. A striking instance of the breaking of a canal bank, due to a pocket-gopher burrow, occurred in the Farmers' Cooperative Canal Co. project of Canyon

County, Idaho, in May, 1919. The canal is 26 miles long and draws 18,000 inches of water, which is used in supplying about 30,000 acres of land. To repair this break cost the company \$5,000, and during the interval before repairs could be completed drought caused a loss of 25 per cent of the hay crop, for the growth of which the irrigation water was intended. Important campaigns are now in progress in irrigated sections with a view to overcoming such losses.



A Costly Pocket-Gopher Burrow.

B1705M

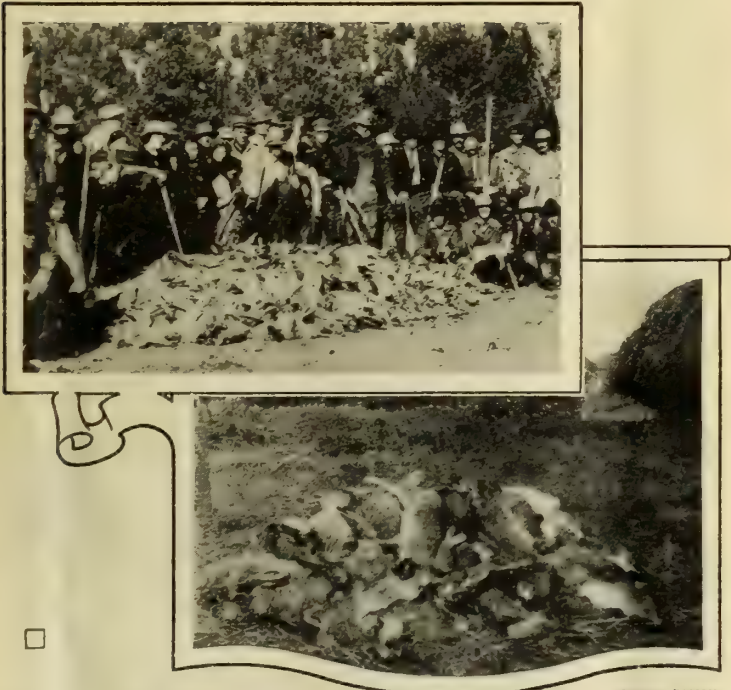
Break in bank of irrigation canal caused by pocket gopher. Besides a bill of \$5,000 for repairs, 25 per cent of the hay crop on 30,000 acres was lost, owing to lack of water, occasioned by the break, at a critical time during the growing period.

### Getting Jack Rabbits With Poison and Drives.

Where jack rabbits are abundant they are responsible for heavy losses of farm crops and range grasses. Many instances have occurred where entire fields of grain were cut down and absolutely destroyed by these animals, and farmers stated that it would be necessary to abandon their farms unless the ravages could be stopped. During the summer jack rabbits frequently gather in great numbers in grain and alfalfa fields. Under such conditions they may completely devastate great areas of growing grain or eat out the crowns



of the young alfalfa, thus preventing its proper growth. During the winter season they congregate about stacks of hay and grain, feeding upon supplies intended for the subsistence of live stock. Their inroads are so serious that a stack is frequently entirely undermined, topples over, and becomes practically a complete loss. They oftentimes seri-



B17378; B1255M

**Poison and Drives Get Results Against Jack Rabbits.**

Farmers and stockmen, tired of seeing growing crops and stacked hay destroyed by jack rabbits, appealed to their Government for assistance. The systematic distribution of poison and the conduct of organized drives have accounted for many thousands of jack rabbits and have afforded practically complete protection from their depredations in localities where the work was undertaken.

ously interfere with the introduction of new and profitable crops, as in the case of lettuce and long-staple cotton in Arizona, and peanuts in Oklahoma, and, by gnawing the bark from the trees, seriously damage orchards.

In Arizona, Idaho, Nevada, Oregon, Utah, and Washington, campaigns for the control of jack rabbits, organized

on a considerable scale, were conducted under the leadership of Biological Survey field representatives in cooperation with local agencies. The animals were destroyed through the use of poison and also by driving them between converging fences into inclosures where they were killed. In Idaho a total of 40,000 rabbits were killed in Minidoka County; and an average of 400 rabbits for each ounce of strychnine used was reported in Lincoln County. Two farmers in Gooding County reported killing 1,000 jack rabbits with each ounce of strychnine. The organized drive also accounted for great numbers. Seven drives conducted in Bingham County, Idaho, netted 15,728 rabbits. Other notable kills through county drives in the State were 5,500 rabbits in Gooding County, 17,800 in Jerome, 20,000 in Lincoln, and 19,000 in Minidoka. One drive in Washington County resulted in killing 10,000 animals.

Practically complete protection of crops was effected during the season of 1920, according to reports received from



Damage to Orchards by Rodents.

B1706M

Roots of orchard trees are cut off and trees killed by pocket gophers and pine mice; the bark is gnawed from the trunk by jack rabbits, cottontails, and meadow mice; and nuts and fruits are frequently eaten and destroyed by ground squirrels, two of which are here pictured, poisoned at their burrow at the root of an orchard tree.

farmers in localities where these campaigns were conducted. Owing to the high price prevailing for skins, a large number from the killed animals were cured and marketed. In many instances the carcasses of rabbits killed in drives were also collected and shipped to city markets to be disposed of for human consumption. In other cases they were utilized as feed for poultry and swine.



Some "Good" Rats from a City Market.

B1617M

Rats are notorious destroyers of food products in all stages, from the planting of the fields to harvest, storage, or use on the farm, in transit to market, at terminal elevators, mills, and warehouses, at the distributing points, and in the pantry of the ultimate purchaser. They not only destroy but contaminate and pollute food products with filth and disease-producing organisms. The rat has been designated as "the most destructive animal in the world" and it fully deserves this invidious distinction. It has no redeeming traits to compensate for its disgusting depredations. Starvation, poison, trap, and exclusion should be its portion everywhere.

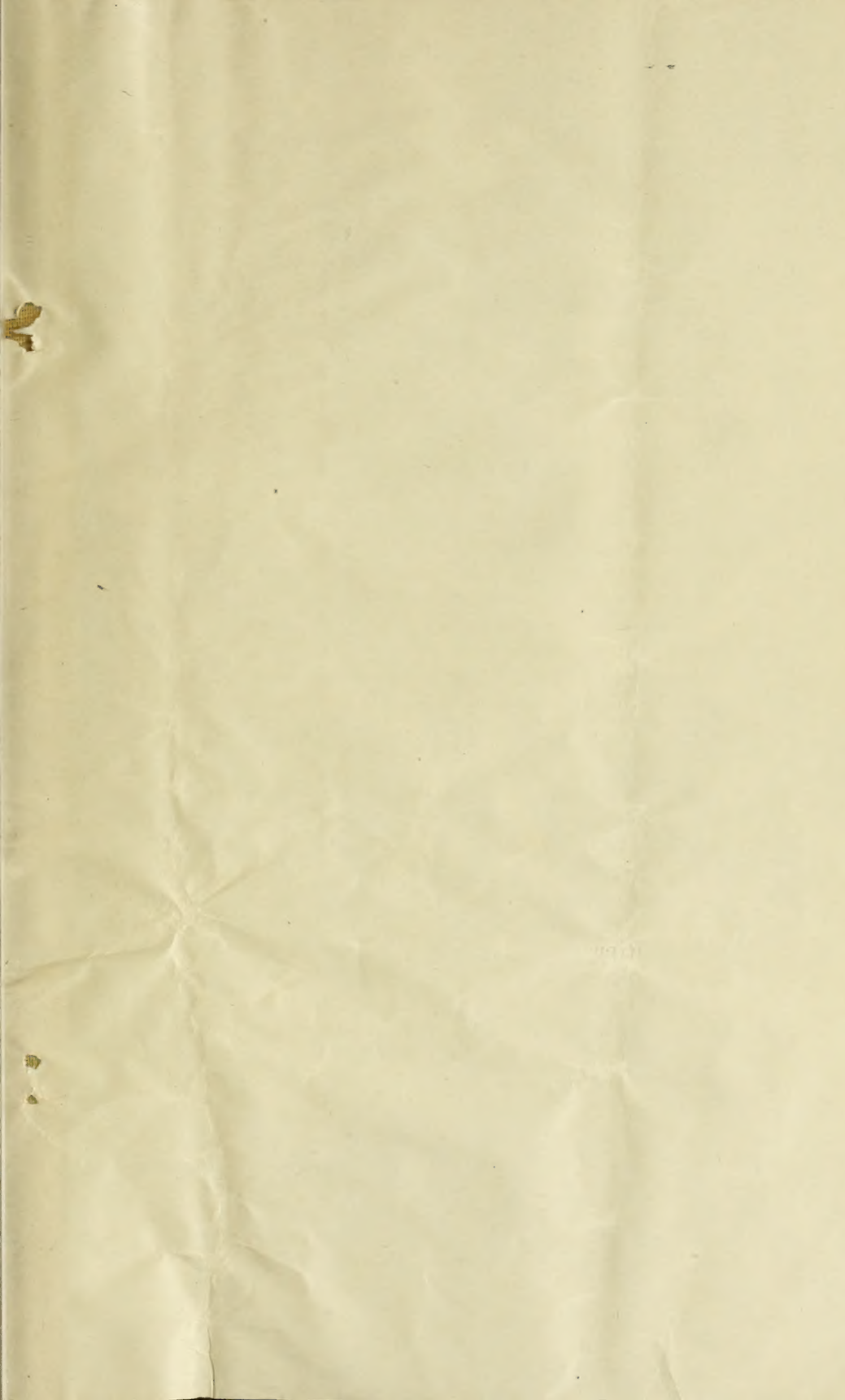
### Thirty Thousand Rat Tails.

The Biological Survey has developed effective, practical, and economical measures for the control of house rats and mice, introduced pests which annually destroy \$200,000,000 worth of crops and stored products in the United States. This sum does not take into account the large amounts expended in efforts to combat them. Recommended methods of

operating against these pests are by means of poisoning and trapping and the rat-proof construction of buildings. An extended educational campaign has been conducted during the past four years in order to acquaint the public with the serious drain on the Nation's food resources through depre-dations of house rats. Demonstrations have been given of methods of poisoning and trapping the animals, and plans for community organization against them have been pre-sented and put into operation at many points. As a result, many State officials, municipal organizations, and public-spirited citizens have taken up the work of organizing cam-paigns, and great numbers of the rodents have been de-stroyed. A campaign recently waged against rats in a small town in Virginia resulted in 30,000 tails being turned in as evidence of its success. Substantial progress has also been made throughout the country in rat-proofing existing build-ings where food and feed products are stored and in intro-ducting rat-proof features into buildings now being planned and constructed. The enormous movement required for an effective fight against these pests, which are both a source of economic loss and a menace to health, appears to be grad-ually taking shape and steadily but surely getting under way.

### Financial Support.

The most convincing evidence that campaigns against rodent pests are getting the desired results lies in the fact that when the Biological Survey began the work no funds were being supplied by the States to help, except for an ap-propriation of \$3,500 in North Dakota. During the fiscal year 1920 funds expended by cooperating State and county organizations and by individuals amounted to \$849,000. Present prospects indicate that this will be materially in-creased from year to year, and the operations are being pressed with unabated vigor and enthusiasm. Most of the States where campaigns are in progress have already en-acted legislation making provision for financing and organ-izing the work in cooperation with the Biological Survey.





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